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A BOTANICAL SURVEY OF THE HURON RIVER VALLEY[1]

VII. POSITION OF THE GREATEST PEAT DEPOSIT IN LOCAL BOGS

GEORGE PLUMER BURNS

(WITH FIVE FIGURES)

The general appearance of the vegetation of the peat bogs in the Huron River valley has been fully described by TRANSEAU (**8**) and it is not necessary to give a detailed account in this paper. The plants are usually growing in a more or less regular zonal arrangement somewhat as follows: (1) open water with submerged plants, (2) water lilies, (3) floating sedge, (4) bog shrubs, (5) tamaracks, (6) maple-poplar, (7) willow or marginal zone.

There is wide variation in the position of the greatest amount of peat deposit and the width of the various zones. Even a casual survey of a number of local bogs emphasizes the fact that the open water is seldom in the center of the original post-glacial lake. The zonal arrangement is usually broken on one side, some zones being entirely lacking. In fact it is not uncommon to have all peat deposit lacking at certain places along the shore. According to some writers (**7**) the greatest accumulation of peat is found on the western side, in regions with prevailing westerly winds. In large basins which are only partly filled it is common to find open water occurring toward the eastern side. The wave-action produced by the westerly wind is supposed to hinder bog plants from obtaining a foothold on the eastern shore. The shoreward push of the ice is also a factor of importance in this connection (**8**, p. 418).

A study of the bogs near Ann Arbor soon revealed the fact that the greatest accumulation of peat on the western side was by no means common to all bogs. In fact the greatest variation was found within very short distances. At Dead Lake it is on the southern side (**1**); at Mud Lake, about one-half mile (800^m) west, it is on the northern side (**6**); at First Sister Lake, it is on the western side (**9**); at a small bog near Carpenter's Corner it is toward the east (**7**).

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[1] Contribution 112 from the Botanical Laboratory of the University of Michigan.

It seems, therefore, that some other factor must be sought. Plane-table maps were made of a number of bogs and the distribution of plants was carefully plotted. Contour maps of the bottoms of the original post-glacial lakes were then made. In making these maps a drill was made of gas pipe, cut in four-foot (1.2^m^) lengths. To the end section was welded a carpenter's auger. With this drill, soundings were made through the peat to the clay bottom of the original post-glacial lake. A base line was run taking the longest diameter of the bog. Along this and at right angles to it, cross lines were drawn every hundred feet (30.48^m^) in large lakes and every fifty feet (15.24^m^) in small lakes. Borings were made at the intersections of these lines and every hundred or fifty feet on the cross lines. Near the shores it was necessary to make the borings closer, often every five feet (1.5^m^). In bogs with open water it was necessary to make all borings through the ice, because it was impossible to hold a boat steady enough to bore through the peat without breaking the drill.

FIRST SISTER LAKE.[2]—This bog is situated a short distance west of Ann Arbor and has already been described by other writers (**8, 9**). It is surrounded on all sides by hills, except for three breaks. To the north was a small post-glacial lake; on the southwest corner it connected, by a narrow channel, with Second Sister Lake. The whole formed a very irregular chain of lakes draining into the Huron River.

The contour map of the bottom of the original post-glacial lake is shown by red lines in *fig. 1*. The heavy line indicates the margin of the original lake as indicated by the peat deposit. The shores rise somewhat abruptly on all sides. The lake had one basin. The deepest part was east of the center, the deepest point being fifty-four feet (16.5^m^). From this point the bottom sloped gradually to the eastern shore. On the opposite side the forty-foot (12.17^m^) contour made a wide divergence to the west; from this contour the bottom sloped gradually to the shore.

No attempt is made to show the flora of this early time. The black of *fig. 1* shows the arrangement of things as they were last summer. The open water occupies a very small area compared to what it did

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[2] Borings were made for the most part by MR. HAROLD STEELE.

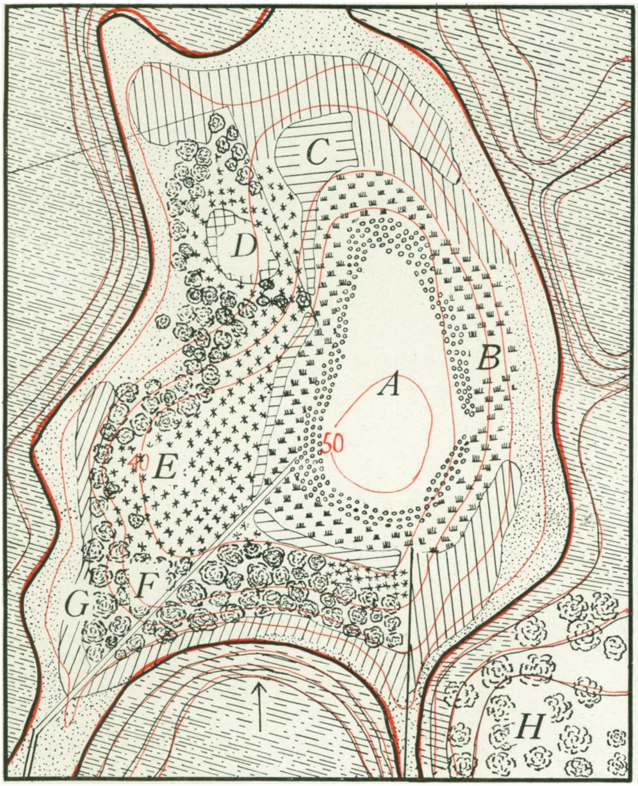

FIG. 1.—First Sister Lake. Contours of the post-glacial lake in red. The heavy line indicates the position of its shore as shown by peat deposit. Scale 1:2880. Contour interval of topography five feet, of hydrography ten feet.

Present distribution of plant societies in black. *A* open water; *B* bog sedge; *C* bog shrub; *D* clearing; *E* tamarack; *F* maple-poplar; *G* willow; *H* oak-hickory.

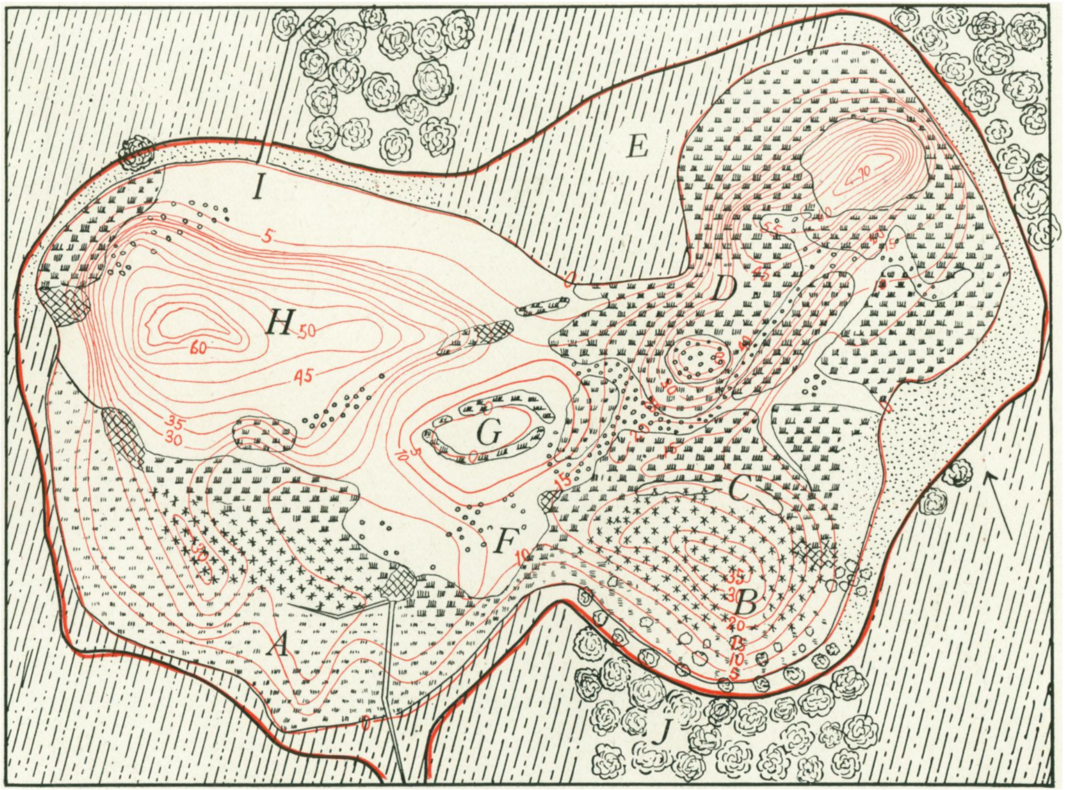

FIG. 3.—Dead Lake. Contours of the bottom of the post-glacial lake in red. The heavy line indicates the position of the shore before drained. The line o indicates the water level when the map was made. Scale 1:4800. Contour interval five feet.

Distribution of plants when the map was drawn in black. *A* area which had been cleared of tamarack before it was suitable for maple-poplar or the clearing society; *B* tamarack; *C* bog shrub; *D* bog sedge; *E* cultivated field; *F* water lilies; *G* island; *H* open water; *I* drain; *J* oak woods.

originally. The volume of water, however, is much smaller than it appears in the figure just referred to, as is seen in a profile through this section of the lake (*fig. 2*). The greatest accumulation of peat is on the western side. The zonal arrangement is also quite different on the two sides. The bog-shrub, tamarack, and maple-poplar zones are almost entirely lacking on the east. On the west, all the zones are present, the tamarack zone being very wide especially in the southwestern portion.

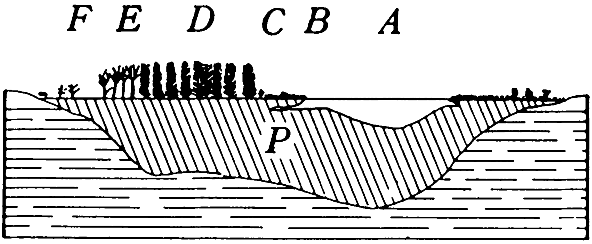

FIG. 2.—First Sister Lake. Profile east and west. *A* open water; *B* bog sedge; *C* bog shrub; *D* tamarack; *E* maple-poplar; *F* willow. Scale: vertical, 1:600; horizontal, 1:2880

In *fig. 1* it is interesting to observe that the open water now lies over the deepest part of the post-glacial lake; and to follow the variations in the width of the tamarack zone. The southern area is broken by areas of bog shrubs, showing that the tamarack has not entirely captured the area. The northern group, on the other hand, is disappearing, and when a number of trees were cut out for wood a few years ago an entirely different society of plants came in—a clearing society. In other words, conditions favoring the development of a tamarack society are found where the original post-glacial lake was forty feet (12.17^{m}) or more in depth, and where the depth was less than this conditions are favorable for the development of the next zone of plants.

BOG NEAR CARPENTER'S CORNER.—This is a small bog east of Ann Arbor. It is surrounded by high hills on the north, west, and south. On the east a narrow ridge about five feet (1.5^{m}) high separates it from a large "drained swamp." A ditch has been dug through this ridge to drain the bog. The original post-glacial lake was small, occupying about one-tenth of an acre ($400^{sq\ m}$). It had only one basin whose greatest depth was fifty-nine feet (18^m). This point was considerably west of the center. The slope of the shore from the eastern margin was very gradual for a distance of nearly one-third the east-and-west diameter, when it becomes very steep. The eastern third of the lake was about fifteen feet (4.57^m) deep. The slope from the western shore was much steeper, and hence the greatest amount of water was west of the center.

Today the open water has entirely disappeared. From the banks a group of tamaracks may be seen. These are arranged around a small central area within which are found (7) a few individuals of the bog-sedge and bog-shrub zones which formerly occupied large areas. Some of the plants found were *Carex filiformis*, *Sphagnum* sp., *Sarracenia purpurea*, *Cypripedium acaule*, and *Vaccinium Oxycoccus*. Outside of this area is a zone of mixed vegetation. The width varies from several rods to a few feet, the widest area being found on the east. The dominant trees are *Acer rubrum* and *Populus tremuloides*. This area has a rather indiscriminate mixture of bog and lowland plants—it is a tension zone in which conditions are not especially favorable to either group of plants. Around this area and following the shore, is found the marginal area so common to bogs. The plants occupying this area are those usually found in low wet places along rivers.

A comparison of this distribution with borings shows that the central area is over the deepest part of the post-glacial lake. The greatest surface accumulation is on the western side where the lake was comparatively shallow, and over this area *Acer rubrum* and *Populus tremuloides* are the dominant trees.

It is thus possible to tell, with considerable accuracy, the depth of the bottom of post-glacial lakes with one basin by the distribution of the present vegetation. The order of succession is lily, bog sedge, bog shrub, tamarack, and maple-poplar. An island of Cassandra located in a zone of *Carex filiformis* indicates a shallow bottom (3), but when it is found in a zone of tamaracks it indicates a deep basin.

DEAD LAKE.[3]—This lake is located about ten miles (16^{km}) north of Ann Arbor. Its longest diameter is nearly directly east and west. Red contours on the map (*fig. 4*) show that the bottom of the post-glacial lake was divided into four basins; a rather shallow ridge running north and south divided it into an eastern and western half, and each half is in turn divided into a northern and southern basin. The central ridge was twelve feet (3.65^m) deep at the lowest point, and in the center it came above the surface, forming an island.

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[3] Mr. FOREST B. H. BROWN assisted in making the borings.

In the eastern half, the northern basin reached a depth of seventy feet (21.33^m) and the southern basin thirty-five (10.66^m) feet. However, a large part of this half of the lake was comparatively shallow. Over a large area the depth was about ten feet (3^m). The other half was also divided into a deep northern basin which reached the depth of seventy-two feet (21.94^m) and a shallower southern basin thirty feet (9.14^m). The greater part of this half of the post-glacial lake was deep. At some time in the past a ditch was dug through the bank on the north and the level of the water was lowered several feet. The conflicting stories told by the older inhabitants make it impossible to determine when this occurred. The vegetation, however, shows that it has been a number of years.

The map of the present distribution of plants at this lake (black parts of *fig. 3*) shows that the peat deposit is largely confined to the south and east. The principal vegetation of the lake is the bog sedge. Only on the south have the tamaracks and the bog shrubs gotten a foothold, though "islands" of these are rapidly spreading over the bog sedge in many places. The absence of the bog flora around the shore of the island in the center of the lake (the vegetation shown on the map is *Scirpus lacustris*), along the northern side of the west half, and on the southeastern corner, is no doubt to be explained in part by the action of the wind, wave, and shoreward push of the ice. However, it must be seen from the map that these places do not stand in a definite relation to the points of the compass. Such vacant places are found where there is shallow water. In just such places the actions referred to above would be most intense. It seems, therefore, that the contour of the bottom rather than the direction of the wind is the controlling factor. The small lake in the northeastern corner is over a very deep basin; the deep western half is for the most part open water. The narrow channels of open water on the eastern portion do not follow the contours but in some places cross them at right angles. Their existence finds its explanation in part in the fact that they are kept open by fishermen who approach the lake chiefly from this side. It is doubtful, however, if this is the entire explanation (4, 5). The break in the tamarack zone on the south side is due to two factors. At this point the water was rather shallow and this hindered occupation by bog plants for a long period of years, as has been pointed out; during late years the tamaracks have been cleared away and the place kept open as a watering place for stock. The large open area south of the tamaracks is an area suited for tamarack growth. The tamaracks formerly growing there were removed for wood and poles before the surface had been raised enough to make it suitable for either the maple-poplar or the clearing society. It is occupied chiefly by marsh ferns and sedges, with a few *Rhus venenata*. A narrow border of *Ulmus americana* is found along the southeastern shore (*fig. 4*).

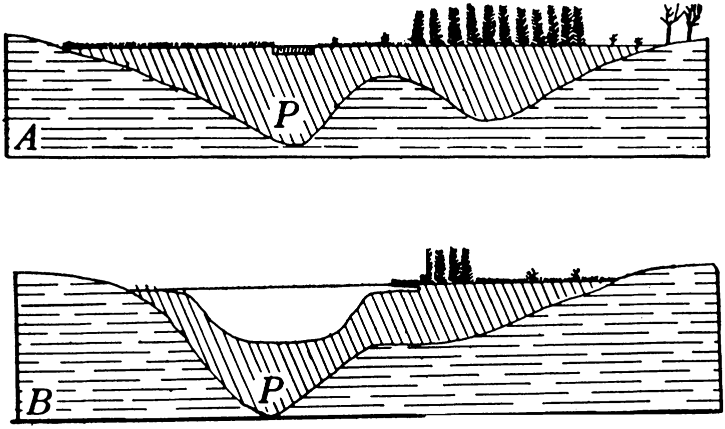

FIG. 4.—Profiles through Dead Lake. *A* through the eastern half; the small body of "open water" is filled with lilies and submerged water plants. *B* conditions in the western part of the lake. Scale: vertical, 1:600; horizontal, 1:4800.

MUD LAKE.—This lake has been described by PENNINGTON (6). It was a very large post-glacial lake but has been almost entirely filled with marl and peat. The greatest deposit of peat is on the northern side, and the open water is very close to the southern shore. In entering the bog from the north one passes through a number of large areas of bog shrubs, wholly or partly surrounded by tamaracks. In these areas are sometimes found small patches of tamarack and spruce. A profile was run across the bog, north and south, through these areas and the open water. This shows that the areas occupied by tamaracks are located over shallow places in the post-glacial lake, and that areas of bog shrubs are located over deeper basins. The borings showed that this lake had a number of basins very much the same as found at Dead Lake. It has reached a later stage of development, however; the dominant vegetation is the bog shrub and tamarack.

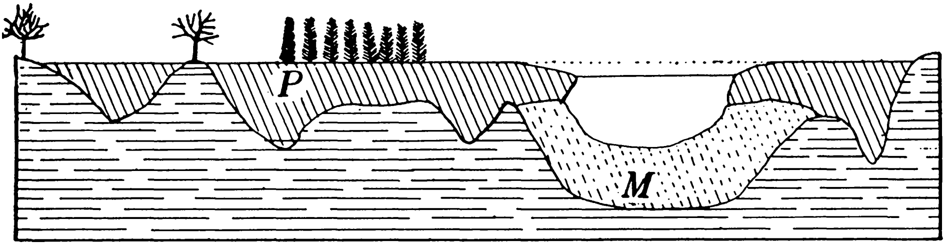

FIG. 5.—Profile north and south through Snow's Lake. The dotted line shows the water level before drained. Scale: vertical 1:300; horizontal, 1:3048.

SNOW'S LAKE.[4]—This lake is located about fifteen miles (24^{km}) west of Ann Arbor. It was formerly a very large lake, but has been almost filled with peat and marl. The bottom of the post-glacial lake was very irregular, as is seen in the profile (*fig. 5*). This profile runs north and south. The deepest and largest basin was near the northern shore; the southern part of the lake was comparatively shallow. A few years ago the lake was drained at the northeastern corner and the level of the water was lowered in the lake. Over the shallow parts of the lake the peat had already become solid, and the draining did not change the level of the surface. Near the open water, however, the plants were still floating, and when the water was drained they sank to the new level. The surface today slants rapidly toward the water; especially is this true for the first few rods immediately next to the open water. It is very surprising from the road to see fine large oak trees growing apparently in the peat bog. However, when one goes over to the oak and examines the soil in which it is growing, the matter is easily explained. These "islands" of oak and other upland trees are not growing in peat, but on one of the islands formed by projections from the bottom of the lake. *Fig. 5* shows such an island with an oak growing upon it.

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[4] A careful study of this lake was made by Dr. JEAN DAWSON, but the results have not been published.

The same relation of present distribution and depth of the original post-glacial lake holds true in lakes with several basins, as it did in lakes with only one: open water over the deepest and largest basins, wide zones of plants where the bottom of the post-glacial lake sloped gradually, a definite order of succession of plant zones. Greater care must be exercised, however, in the determination of depths by the present vegetation, especially in lakes with many small basins just at the time when large areas are beginning to become favorable for the next group of plants. The occupation will take place most rapidly over shallow parts, because here the peat will become firm sooner and the conditions will first be favorable for the next group of plants.

CONCLUSIONS.—The chief factor determining the position of the greatest amount of peat deposit and the width of the zones of plants at the local peat bogs is the depth of the water in the different parts of the original post-glacial lakes. The chief factor in determining the position of the open water is depth; given time enough, the open water will disappear from all our lakes.

In places where the water is very shallow the bog flora is unable to get a start because of the wave-action caused by the winds and on account of the shoreward push of the ice. Such places, however, bear no definite relation to the points of the compass.

Different zones of plants follow in a definite orderly succession; lily, bog sedge, bog shrub, tamarack, maple-poplar.

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LITERATURE CITED

1. BURNS, G. P., Formation of peat in Dead Lake. Rept. Mich. Acad. Sci. **6**:76. 1904.
2. ———, Edaphic conditions in local peat bogs. Science N. S. **29**:269. 1909.
3. COWLES, H. C., Physiographic ecology of Chicago and vicinity. BOT. GAZETTE **31**:147. 1901.

4. GANONG, W. F., The vegetation of the Bay of Fundy salt and diked marshes. BOT. GAZETTE **36**:174 and footnote. 1903.
5. ———, On the physical geography of Miscou. Bull. Nat. Hist. Soc. New Brunswick **5**:460.
6. PENNINGTON, L. H., Plant distribution at Mud Lake. Rept. Mich. Acad. Sci. **8**:54. 1906.
7. PETTEE, EDITH E., Plant distribution in a small bog. Rept. Mich. Acad. Sci. **7**:126. 1905.
8. TRANSEAU, E. N., The bogs and bog flora of the Huron River valley. BOT. GAZETTE **40**:429–448. 1905. The older literature is given by this author.
9. WELD, L. H., Botanical survey of the Huron River valley. II. A peat bog and a morainal lake. BOT. GAZETTE **37**:36. 1904.